results he found were 52·7 and 51·5. The mean initial temperature in these two experiments is −8°·7 C., and the mean final temperature −7°·2 C. At −7°·2 C., ice would form on cooling, and would melt on warming a solution of chloride of sodium containing 6·48 per cent. Cl, which represents 11·87 per cent. of the sea salt. In order to concentrate a brine containg 3·53 per cent. salt to one containing 11·87 per cent., 70 per cent. of the water in it must be removed. Hence in sea-water freezing at a final temperature of −7°·2 C., there is formed 70 per cent. of ice, and there remains liquid 30 per cent. of brine. Freezing began at the mean temperature −8°·7 C., and the latent heat of pure ice at this temperature is 75. Calculating the latent heat of this mixture from the heat liberated in the calorimeter during freezing, and assuming that the whole mass had solidified, Pettersson's results give the mean latent heat of this sea-water as 52·1. Calculating the apparent latent heat on the assumption that 70 per cent. of the mass solidifies into pure ice and that 30 per cent. remains liquid, we get the number 51·5. On all grounds therefore we must conclude that pure ice is the primary product in freezing sea-water and saline solutions of moderate concentration.

The fact that ice melts in sea-water at a temperature of −1°·6 C. to −1°·8 C., according to its saltness, explains the anomalous distribution of temperature in Antarctic waters, and furnishes an account of the motive power which draws the surface water of cold temperate regions into the deeper layers, and after dilution with the melted matter of the icebergs, to the surface layers of Antarctic latitudes. Forming as it does an important factor of oceanic circulation, this part of the subject was treated in a separate paper, of which an account has already been given in NATURE (vol. xxxv. p. 516).

THE CLASSIFICATION OF SPIDERS.[1]

ALTHOUGH Dr. Thorell's paper is nominally only a criticism of Dr. Bertkau's views, it is really a masterly sketch of the literature on the subject of the classification of spiders, and a review of the methods of various authors from Lister downwards. The two leading views at present held on this subject appear to be represented by the author (Dr. Thorell) and Dr. Bertkau. These two views may be stated generally as *anatomical* v. *biological*, the former being the basis of Dr. Bertkau's classification, the latter (combined with considerations of external structure) that of Dr. Thorell. Dr. Thorell successfully, as it appears to us, defends the classification provisionally adopted in 1869, in his work "On European Spiders," from the sweeping charge that it is neither natural nor equal, nor based on characters of sufficient importance and distinctly expressed, though at the same time he freely admits its inevitable imperfection. He shows that in no branch of Nature are the subordinate groups of exactly equal value, nor should it be expected that the same equal systematic value would be found in the subordinate groups of the class Arachnida. It is well to remember that zoologists have to form their groups out of such materials as have come to their hands ready provided for them by Nature. They cannot expect to advance natural science by constructing out of limited materials a perfectly symmetrical system, and then insisting that all the diverse forms of Nature shall, *nolens volens*, be stuffed somewhere or other into it. Equality, therefore, of systematic value in the various groups into which spiders (Araneidea) may be divided can at best be only approximate; and it seems evident that as our knowledge of structure, whether external or internal, or of habits as dependent on and arising out of structure, becomes more extensive and exact, so some further modifications may become necessary in the primary divisions of spiders. After subjecting Dr. Bertkau's classification (which is based principally on the breathing-organs) to a minute and destructive criticism, Dr. Thorell modifies his former views by reverting, in some measure, to the Latreillian division of spiders into (1) those possessing four air-sacs, *Tetrapneumones*; (2) those with two, *Dipneumones*; still, however, retaining the old Latreillian biological divisions, *Territelariæ*, *Tubitelariæ*, *Orbitelariæ*, &c., based on habits, because the groups so divided may yet be thoroughly and scientifically differentiated by important and trustworthy structural characters. These divisions (now called by Dr. Thorell "tribus") are, as is well known, seven in number, and each is subdivided into families, which, with few exceptions, include only European species, Dr. Thorell's opportunities for the study of exotic groups not enabling him to construct a more complete subdivision of all known spiders. Dr. Bertkau's primary division of the Araneidea is into two groups, called suborders—*Tetrasticta*, with four breathing-apertures, and *Tristicta*, with three. Dr. Thorell shows conclusively that in the present state of our knowledge of the respiratory system of spiders (though this is far advanced beyond what it was in Latreille's days, and in a great degree the advancement is admitted to be due to Dr. Bertkau's labours) these two suborders are artificial rather than natural; as are also his subdivisions of the *Tristicta*, which are based on the undoubtedly remarkable characters to which such great prominence was given by the late Mr. Blackwall, that is, the possession or absence of a *cribellum* and *calamistrum*, the use of these in primary subdivision bringing together spiders not closely allied by any other natural characters. Dr. Thorell attributes a certain amount of classificatory importance to these organs by his intercalation of the families of his largest "tribus" possessing them, in a kind of osculant or collateral way, and of the other "tribus" in which they are found, in a linear arrangement, guided, however, in both cases by their possessing such other characters as, in all instances, fully warrant the position assigned to them. The anatomical study of the *tracheæ* (properly so called) of spiders seems to be yet in its infancy. Certainly at present these organs of respiration do not appear to warrant the importance attributed to them by Dr. Bertkau; and although Dr. Thorell's primary subdivisions are, in their *names*, strictly speaking, based on only biological characters, yet in reality they severally enshroud the most important structural ones, and hold all known spiders in a fairly natural system. They are, moreover, well known, and appear likely to be adopted for some time yet to come, with more or less modification, by the majority of araneologists.

O. P. CAMBRIDGE.

CHRISTMAS ISLAND.

THE following account of the little-known Christmas Island, situated in the Indian Ocean, south of Java, may be of interest. Capt. Maclear and his officers collected a variety of specimens, which have been forwarded to the Museum of Natural History and to the Royal Gardens, Kew, but they do not seem to have succeeded in making their way through the dense jungle to the upper part of the island, to ascertain the geological character of the mountain originally protruded from the depths. It is a little remarkable that, in a sea so calculated to encourage coral growth, no new reefs should have formed round the island since the ancient ones were elevated above the surface The Cocos or Keeling

---

[1] "On Dr. Bertkau's Classification of the Order Araneæ, or Spiders," by Dr. T. Thorell (*Ann. and Mag. N.H.*, April 1886, pp. 301–26). (See especially the following works by Dr. Bertkau:—"Versuch einer natürlichen Anordnung der Spinnen," *Archiv. für Naturgeschichte*, xliv. 1, pp. 351 *et seq.*, 1878; and "Ueber das Cribellum und Calamistrum; ein Beitrag zur Histologie, Biologie, und Systematik der Spinnen," *ibid.*, xlviii. 1, pp. 316 *et seq.*, 1882.)

© 1887 Nature Publishing Group

Islands, 500 miles to the westward, are a well-known example of thriving coral life.

W. J. L. WHARTON.

H.M. Surveying-Vessel "Flying-Fish," January 31, 1887.

Christmas Island is 190 miles from the nearest point of Java, from which it is separated by a depth of 2450 fathoms. It is formed of coral limestone, has no fringing reef, but rises abruptly from the sea in cliffs about 30 feet high, very much underworn, and in many places hollowed out in caverns; the shore is steep-to: generally a depth of 100 fathoms is found at one to two cables from the cliffs.

In appearance it is somewhat saddle-shaped, rising from a long back in the middle, 700 to 800 feet high, to hills at the north-eastern and at the western sides; the western summit is double, and is the best-defined mark: its height is 1580 feet. The shape is irregular quadrilateral; it extends through 12′ of latitude, and about the same in longitude.

The island is densely wooded all over, except where the cliffs are too steep to allow anything to grow. From the northern side the ascent is gradual to the highest parts; but on the southern side, after rising gradually for half a mile from the sea cliffs, a second wall of limestone cliffs is met, estimated at 200 to 300 feet high, and thence slopes gently again to the top.

The shore cliffs are almost continuous, making the island inaccessible except at a few places. These cliffs are split by deep fissures extending several feet below water; where these have become enlarged, and the adjacent cliffs have fallen in, a small white beach of fragmentary rock is thrown up, and at such places on the lee-side landing can be effected.

From the blown direction of the trees on the south side, and from the weather-worn aspect of rocks exposed to the southward, it is manifest that the south-eastern is by far the prevailing wind.

The north side of the island forms a large bight, in which the water is quite smooth, so that a boat can go close up to the cliffs, but on the southern and eastern sides a heavy sea dashes against the rocks.

The *Flying-Fish* steamed close round the island looking for anchorage, but found none, except in a small cove two miles to the westward of the north point of the island—this has been named Flying-Fish Cove; here she anchored in 22 fathoms, with her stern secured by hawsers to the trees, to prevent slipping off the bank.

The hill rises nearly perpendicularly at the head of the cove in the form of a horseshoe, and slopes gradually down to the two arms forming the cove. The bare beach is not more than 20 yards wide, and, from the look of the fragments that compose it, must be thrown up in northerly gales; the upper part of the beach to the foot of the hill, a distance of some hundred yards, is of just the same material, viz. fragments of coral rock and coral limestone, but it has a covering of mould from fallen leaves, and is thickly wooded, many of the trees on it being forest trees of 12 feet girth and of great height, apparently hundreds of years of age, showing that a very long time must have elapsed since that beach was raised from the water.

One very large tree had something like the letters **W W** cut inside a scroll, and nearly illegible from time; this was the only sign of the island having been visited before; but one of our officers heard at Batavia that a Dutch vessel was wrecked on the south-east point of the island in a calm about fifteen years ago, and that the crew escaped and lived many months on the island before they were taken off, but I have no other details about the affair.

No running water was seen, but the droppings from the leaves during rain and dew must be great, as holes in the rocks and cup-shaped leaves were filled with water. As it was raining over some part of the island (generally the western) great part of the time the *Flying-Fish* was in the neighbourhood, and clouds were continually being formed over the island from the moist air driven up the side by the south-east wind, a great deal of water must be deposited, and probably be absorbed by the soil. At the eastern end of the cove, among the trees, where had seemed at first the most likely place for a watercourse, a few volcanic stones were found, but everywhere else the only rock seen was coral limestone; the cliffs above from which detached pieces had fallen to the beach were the same; the soil under the trees was a rich moist mould, apparently formed from decaying vegetation.

Landing was also effected at another small beach in the northern bight near the north-west point; the general features were the same, but there was no anchorage at half a cable from the shore. A few cocks and hens were landed here, but as the crabs immediately began to chase them, I doubt if they will survive and produce.

No large animals were seen, nor marks of any. An iguana, said to be 4 feet in length, was seen in a tree, high up, but was not captured. Rat-holes were numerous, and one rat was secured, also a large bat. Several insects, spiders, flies, beetles, and butterflies, were collected; there were sand-flies, but no mosquitoes. Large crabs were very plentiful, and appeared equally at home running over the sea-cliffs and climbing up the trees; they were very ravenous, pouncing quickly on a dead gannet and devouring other injured crabs, and they must be terrible enemies to the birds generally.

Gannet and frigate-birds frequent the island, and evidently breed there, but it was not the breeding-season, and very few eggs were found; the young birds were nearly grown. Besides the sea-birds there was the large green Torres Strait pigeon: one was shot, with three large red berries in his crop. These pigeons seemed to frequent the higher trees well up the hill. Also a ground-thrush, of a sooty-brown colour, just the colour of the fallen leaves among which it ran nimbly, apparently looking for insects; and a little fly-catcher of the same sombre colour. As evening advanced, a small swift appeared, which flew about the jungle on the margin of the beach, fly-catching: none of these three last were secured. No bones were found on the beach, nor remnant of any animal; not even turtle-remains.

The flora appeared to be the same as that of the neighbouring islands, the Moluccas. As before stated, the island is densely wooded, and many of the trees attain great size. Chief amongst them I recognized two iron-wood trees, one with straight stem and round trunk, and the other with strong buttresses from the roots; both are natives of Celebes. Creepers were as thick as in the Moluccas, and covered the top branches of the trees.

Two palms—one I take to be the sago-palm, growing to a great height; and the pandanus—were abundant: cocoanut trees were not seen, though husks were found on the beach, apparently washed up from elsewhere. At a small beach on the eastern side there appeared to be banana-trees, but they looked withered and there were no signs of fruit.

No mangroves were seen: the flora of the coast was generally such as is found in all tropical islands.

I regret to say that nearly all the botanical specimens that were collected were destroyed by insufficient drying in the exceedingly damp weather we experienced.

(Signed) J. P. MACLEAR,
Captain.

NOTES.

ON March 9, on the invitation of the Chief Justice of Queensland, a public meeting was held at Brisbane, to consider the establishment of a University for that colony. A resolution was

© 1887 Nature Publishing Group